

CLAIMS

WHAT IS CLAIMED IS:

1. An excimer laser system comprising:
- A) a laser chamber containing:
 - 1) two spaced apart elongated electrodes;
 - 2) a laser gas comprising:
 - at least one noble gas and fluorine,
 - 3) two window housings each housing a window,
 - B) a blower for flowing the laser gas between the two spaced apart electrodes;
 - C) a fluorine source;
 - D) a metal fluoride trap;
 - E) a fluorine monitor comprising an absorption cell and a light source for producing light in said absorption cell in a spectral range of relatively high absorption in F₂ gas,
 - F) a gas sampling circulation system for extracting a first small portion of said laser gas downstream of said blower directing said small portion to said metal fluoride and then directing all or a second portion of said first small portion through said sample cell and then to one of said window housings;
 - G) a fluorine control system to regulate the concentration of fluorine gas in said laser chamber based on signals from said fluorine washer.
2. An excimer laser system as in Claim 1 wherein said light source is an ultraviolet light source.

1 3. An excimer laser system as in Claim 2 wherein said monitor further
2 comprises a light detector and an optical system to direct a portion of ultraviolet light from
3 said light source through said absorption cell to said light detector.

1 4. An excimer laser system as in Claim 3 wherein said fluorine monitor also
2 comprises a reference cell.

1 5. An excimer laser system as in Claim 1 wherein said fluorine monitor also
2 comprises a filter device comprising a plurality of filters and a means for successively
3 placing each filter in said plurality of filters in said beam of ultraviolet lights.

1 6. An excimer laser system as in Claim 1 wherein said excimer laser system is a
2 KrF laser system and said at least one noble gas is krypton and also comprising neon as a
3 buffer gas.

1 7. An excimer laser system as in Claim 1 wherein said excimer laser system is
2 an ArF laser system and said at least one noble gas is argon and also comprising neon as a
3 buffer gas.

1 8. An excimer laser system as in Claim 1 wherein said excimer laser system is
2 an F₂ laser system.

1 9. An excimer laser system as in Claim 1 wherein said fluorine control system
2 comprises temperature and pressure sensors and a processor programmed to adjust fluorine
3 injection based on temperature deviations from a reference temperature.

1 10. An excimer laser system as in Claim 1 wherein said laser feedback control
2 system is programmed to control fluorine flow to keep said laser operating within a
3 predetermined sweet spot.

1 11. An excimer laser system as in Claim 10 wherein sweet spot is defined as a
2 range of fluorine concentration.

1 12. An excimer laser system as in Claim 10 wherein said sweet spot is defined by
2 a slope of a voltage vs. F_2 concentration curve.

1 13. An excimer laser system as in Claim 12 wherein said fluorine control system
2 is programmed to inject fluorine at intervals close enough together to simulate continuous
3 injection in order to permit a voltage defined sweet spot no larger than about 2 percent of the
4 nominal sweet spot voltage.

1 14. An excimer laser system as in Claim 1 wherein said fluorine source is a
2 source of substantially 100% fluorine.

1 15. An excimer laser system as in Claim 1 wherein said feedback fluorine control
2 system is programmed to increase the chamber gas pressure as the chamber ages.

1 16. An excimer laser system as in Claim 2 wherein said fluorine monitor is an
2 acoustic monitor and comprises a pulse light source at least a portion of which is within a
3 spectral range of relatively high absorption in F_2 gas, and further comprises a microphone for
4 monitoring acoustic waves in said absorption cell.

1 17. An excimer laser system as in Claim 16 wherein said absorption cell is
2 configured to establish at least one acoustic standing wave.

1 18. An excimer laser system as in Claim 17 wherein said absorption cell
2 comprises an entrance port and an exit port located at node locations of said at least one
3 standing wave.

1 19. An excimer laser system as in Claim 18 wherein said absorption cell
2 comprises two windows to permit entrance and exit of light from said pulse light source
3 wherein each of said two windows are located at a node location of said at least one standing
4 wave.

1 20. An excimer laser system as in Claim 18 wherein said absorption cell
2 comprises a cylindrical internal cavity defining an axis and further comprises two windows
3 positioned on said axis.

1 21. An excimer laser system as in Claim 20 wherein said absorption cell also
2 comprises two buffer cavities.

1 22. An excimer laser system comprising:

- 2 A) a laser chamber containing:
- 3 1) two spaced apart elongated electrodes;
- 4 2) a laser gas comprising:
- 5 at least one noble gas and fluorine,
- 6 3) two window housings each housing a window,
- 7 B) a blower for flowing the laser gas between the two spaced
- 8 apart electrodes;
- 9 C) a fluorine source;
- 10 D) a metal fluoride trap;
- 11 E) a fluorine monitor comprising an absorption cell and a light
- 12 source for producing light in said absorption cell in a spectral
- 13 range of relatively high absorption in F₂ gas,
- 14 F) a gas sampling circulation system for extracting a first
- 15 small portion of said laser from said laser chamber and
- 16 directing said small portion through said sample cell;
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1 G) a fluorine control system to regulate the concentration of
2 fluorine gas in said laser chamber based on signals from said
3 fluorine washer.

1 23. An excimer laser system as in Claim 1 wherein said light source is an
2 ultraviolet light source.

1 24. An excimer laser system as in Claim ²²1 wherein said excimer laser system is a
2 KrF laser system and said at least one noble gas is krypton and also comprising neon as a
3 buffer gas.

1 25. An excimer laser system as in Claim ²²1 wherein said excimer laser system is
2 an ArF laser system and said at least one noble gas is argon and also comprising neon as a
3 buffer gas.

1 26. An excimer laser system as in Claim ²²1 wherein said excimer laser system is
2 an F₂ laser.

1 27. An excimer laser system as in Claim ²²1 wherein said fluorine control system
2 comprises temperature and pressure sensors and a processor programmed to adjust fluorine
3 injection based on temperature deviations from a reference temperature.

1 28. An excimer laser system as in Claim 1 wherein said fluorine control system is
2 programmed to control fluorine flow to keep said laser operating within a predetermined
3 sweet spot.

1 29. An excimer laser system as in Claim 28 wherein sweet spot is defined as a
2 range of fluorine concentration.

1 30. An excimer laser system as in Claim 28 wherein said sweet spot is defined by
2 a slope of a voltage vs. F_2 concentration curve.

1 31. An excimer laser system as in Claim 12 wherein said fluorine control system
2 is programmed to inject fluorine at intervals close enough together to simulate continuous
3 injection in order to permit a voltage defined sweet spot no larger than about 2 percent of the
4 nominal sweet spot voltage.

A 1 32.. An excimer laser system as in Claim ²² wherein said fluorine source is a
2 source of substantially 100% fluorine.

09191446 "11298" A 1 33. An excimer laser system as in Claim ²² wherein said feedback fluorine control
2 system is programmed to increase the chamber gas pressure as the chamber ages.

1 34. An excimer laser system as in Claim 22 wherein said fluorine monitor is an
2 acoustic monitor and comprises a pulse light source at least a portion of which is within a
3 spectral range of relatively high absorption in F_2 gas, and further comprises a microphone for
4 monitoring acoustic waves in said absorption cell.

1 35. An excimer laser system as in Claim 34 wherein said absorption cell is
2 configured to establish at least one acoustic standing wave.

1 36. An excimer laser system as in Claim 35 wherein said absorption cell
2 comprises an entrance port and an exit port located at node locations of said at least one
3 standing wave.

1 37. An excimer laser system as in Claim 36 wherein said absorption cell
2 comprises two windows to permit entrance and exit of light from said pulse light source
3 wherein each of said two windows are located at a node location of said at least one standing
4 wave.

1 38. An excimer laser system as in Claim 37 wherein said absorption cell
2 comprises a cylindrical internal cavity defining an axis and further comprises two windows
3 positioned on said axis.

1 39. An excimer laser system as in Claim 38 wherein said absorption cell also
2 comprises two buffer cavities.

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